
स्वचल वाहन — उपकरण
तंत्र — तापमान गेज — विद्युत
एवं इलेक्ट्रानिक प्रकार — विशिष्टि
(पहला पुनरीक्षण)

**Automotive Vehicles — Instrument
Systems — Temperature Gauges —
Electrical and Electronic Type —
Specification**
(*First Revision*)

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FOREWORD

This Indian Standard (First Revision) was adopted by the Bureau of Indian Standards, after the draft finalized by the Automotive Electrical Equipments and Instruments Sectional Committee had been approved by the Transport Engineering Division Council.

This standard was first published in 1993. In this revision, besides other changes, scope has been enlarged to include electronic type temperature gauges.

Electrical/Electronic type temperature gauges are used for indicating the temperature of the lubricating oil or cooling water.

For the purpose of deciding whether a particular requirement of this standard is complied with, the final value, observed or calculated expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

AUTOMOTIVE VEHICLES — INSTRUMENT SYSTEMS — TEMPERATURE GAUGES — ELECTRICAL AND ELECTRONIC TYPE — SPECIFICATION

(*First Revision*)

1 SCOPE

This standard specifies the requirements for electrically/electronically operated temperature gauges used to indicate temperatures of cooling water or lubricating oil of automotive engines.

2 REFERENCES

The following standards contain provisions which through reference in this text, constitute provisions of this standard. At the time of publication, the editions indicated were valid. All standards are subject to revision and parties to agreements based on this standard are encouraged to investigate the possibility of applying the most recent editions of the standards indicated below:

<i>IS No.</i>	<i>Title</i>
2500 (Part 1) : 2000	Sampling inspection procedures : Part 1 Attributes sampling plans Indexed by acceptable quality level (AQL) for lot by lot inspection (<i>third revision</i>)
9000	Basic environmental testing procedures for electronic and electrical items:
(Part 2/Sec 3) : 1977	Cold test, Section 3 Cold test for non- heat dissipating items with gradual change of temperature
(Part 3/Sec 3) : 1977	Dry heat test, Section 3 Dry heat test for non-heat dissipating items with gradual change of temperature
(Part 5/Sec 2) : 1981	Damp heat (cyclic) test, Section 2 12 + 12 h cycle
(Part 7/Sec 2) : 1979	Impact test, Section 2 Bump
(Part 7/Sec 3) : 1979	Impact test, Section 3 Drop and topple
(Part 8) : 1981	Vibration (Sinusoidal) test
(Part 11) : 1983	Salt mist test
(Part 12) : 1981	Dust test
(Part 14/Sec 2) : 1988	Test N : Change of temperature, Section 2 Test Nb : Change of temperature (temperature cycling) with specified rate of change — One chamber method

<i>IS No.</i>	<i>Titles</i>
(Part 16) : 1983	Driving rain test
ISO 7637-2 : 2004	Road vehicles — Electrical distur- bances from conduction and coupling — Part 2 : Electrical transient conduction along supply lines only
ISO 7637-3: 1995	Road vehicles-Electrical distur- bances by conduction and coupling — Part 3 : Vehicle with nominal 12V or 24V supply voltage — Electrical transmission by capacitive and inductive coupling via lines other than supply lines

3 TYPES AND CLASSES

- | | |
|-------------------------------------|--|
| (a) Class 1 (Coil type) | — Variable
resistance type
sensor unit |
| (b) Class 2 (Stepper motor
type) | — Variable
resistance
type sensor unit |

4 GENERAL REQUIREMENTS

4.1 The gauges shall comprise an integrated (Unitized) sensor receiver unit (*see* Fig. 1).

4.2 The graduation shall be in degree Celsius.

Typical dimensions may be specified. Arrangements for illumination shall be provided. Luminance of display shall be between 2 – 10 cd.

4.3 The plated and exposed areas shall be free from uneven plating, any significant flaws or any other injurious defects.

4.4 The painted surface shall be uniform and free from lumps or any other irregularities.

5 SAMPLING

Unless otherwise agreed upon, the sampling plan shall be in accordance with IS 2500 (Part 1).

6 TESTS

6.1 Test Conditions

The conditions for gauge shall be as follows, unless otherwise specified:

- a) Temperature and humidity at the test place shall be kept constant, in the specified error tests, the temperature shall be 15 to 35°C and humidity shall be 45-75 percent.
- b) Mounting condition shall be determined on the kind of vehicles.
- c) Thermometer with a least count of $\pm 0.5^\circ\text{C}$ shall be used for the temperature measurement.
- d) Test voltage shall be as shown in Table 1.
- e) In the indication error test, slight vibration to the receiver unit or tapping of the unit to be done to remove influence of any frictional resistance.
- f) Ohm meter least count shall be within $\pm 0.3 \Omega$.

Table 1 Test Voltages
(Clause 6.1)

Sl No.	Nominal Voltage V	Performance Test Voltage V	Endurance Test Voltage V
(1)	(2)	(3)	(4)
i)	12	13.5	14 ± 0.5
ii)	24	27.0	28 ± 1.0

6.1.1 Test Performance

The gauge shall be mounted on the same position as it is in the vehicle and tested over its last two third of the range. Site readings shall be taken in ascending order.

6.2 Indication Error Test

Indication error of gauges shall be as shown in Table 2.

6.3 Delay of Indication

When the sensor unit of the gauge is transferred from a warm solution at about 75°C to the liquid phase of maximum graduated temperature the pointer shall indicate temperature higher than 90 percent of the highest graduation temperature, within 2 min.

6.4 High Voltage Test

When the receiver unit of the gauge is kept at 60°C in operating mode at 14 V/28 V and voltage increases by 1 V at a time till 17 V/32 V, for 12 V/24 V system, allowing to remain for 2 h at each step. There shall be no failure (fracture) of parts.

6.5 Heating and Rapid Cooling

When the sensor unit of the gauge is kept in a liquid solution tank at about 80 percent of the highest graduation temperature for 5 min and then immediately cooled in the water at $25 \pm 5^\circ\text{C}$ for 5 min, and this process is repeated three times, no abnormalities shall be observed. The permissible variation of the observed values from the initial values shall be ± 2 percent of full scale value.

6.6 Insulation Resistance Test

When the insulation resistance is measured between the receiver unit terminals and outer case at normal temperature with a 500 V insulation resistance meter, it shall be more than 1 mega-ohm. This test is applicable for insulated type meters only.

6.7 Damp Heat Cyclic Test (Operation)

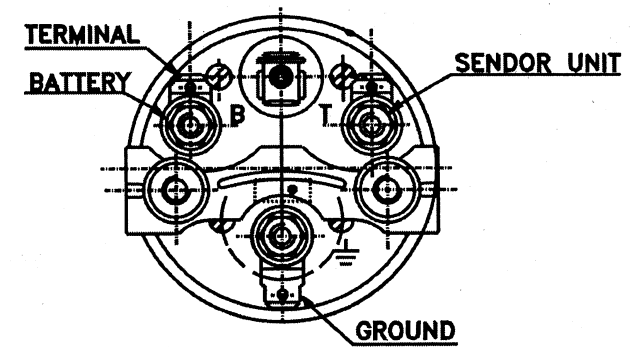
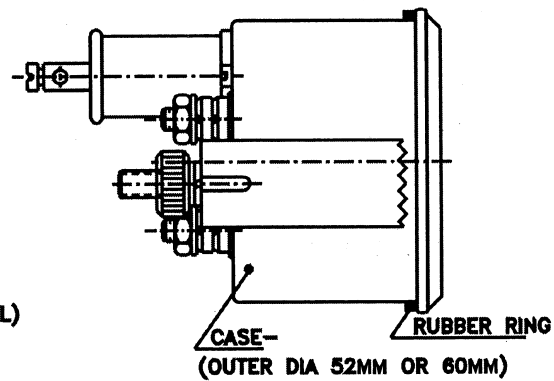
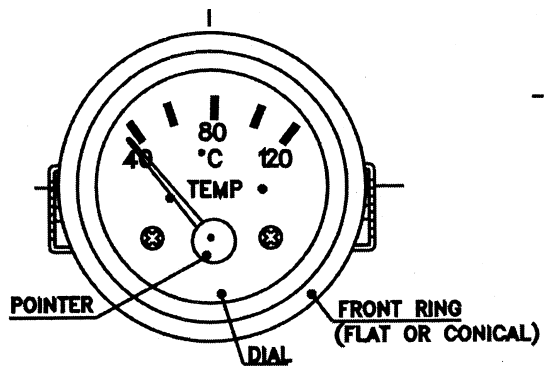
Indicator and sensor under test shall be kept inside damp heat chamber under specified condition according to IS 9000 (Part 5/Sec 2) and externally switched on conditions throughout complete two cycle. Indicator shall show inside temperature of the chamber. After the test each part shall be free from any abnormalities and the permissible variation between the observed value from the initial value shall be ± 2 percent of full scale value.

6.8 Temperature Resistance

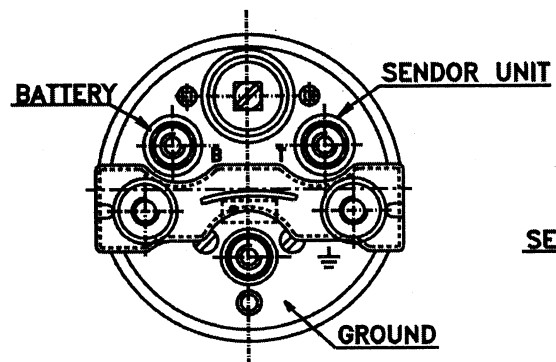
6.8.1 When the receiver unit of the gauge is tested as specified in IS 9000 (Part 14/Sec 2) each part shall be free from any abnormalities and shall comply with **6.3** and **6.4**. The permissible variation between the observed value from the initial value shall be ± 2 percent of full scale value.

Table 2 Indication Errors of Gauges
(Clause 6.2)

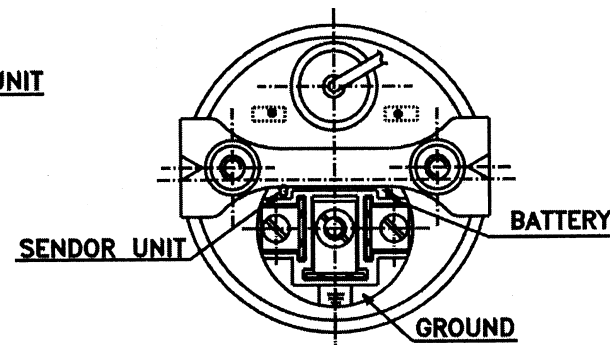
Receiver Unit (1)		Sensor Unit (2)	
Unless otherwise specified, the receiver unit shall be accurate to within ± 1.5 angular degree at primary calibration point and ± 3.0 angular degree at secondary calibration point. Light vibrate or three light taps shall be used before taking readings.		The calibration points shall be defined by the manufacturer in terms of sending unit resistance tolerance and measured parameter tolerance at the primary and secondary calibration points	
Calibration Point (Units of measured parameter) Primary	Calibration Point (Units of measured parameter) Secondary	Calibration Point (Units of measured parameter) Primary	Calibration Point (Units of measured parameter) Secondary
± 1.5 angular degree Ascending temperature	± 3.0 angular degree Ascending temperature	$\pm 3^\circ\text{C}$, Ascending temperature	$\pm 10^\circ\text{C}$, Ascending temperature or as agreed to between the user and the manufacturer



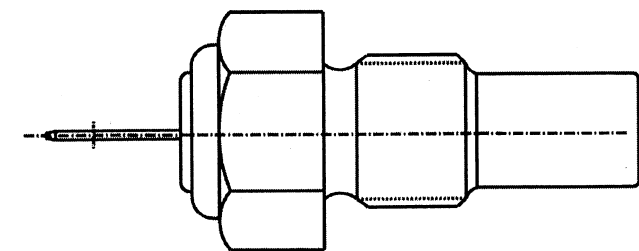
SPADE TERMINAL TYPE



ROUND TERMINAL TYPE



SOCKET TYPE



SENDOR UNIT

FIG. 1 ELECTRICAL/ELECTRONIC TEMPERATURE GAUGE

6.8.2 Cold Test

When the receiver unit of the gauge is tested as specified in IS 9000 (Part 2/Sec 3) with a gradual change of temperature under the following conditions:

- a) Temperature : $-10 \pm 3^{\circ}\text{C}$
- b) Duration of exposure : 2 h

After test, the permissible variation between the observed value from the initial value shall be ± 2 percent of full scale value.

6.9 Vibration Resistance

When the gauge is tested as specified in IS 9000 (Part 8), the receiver unit and the sending unit shall be capable of withstand 18 h of vibration, 6 h along each of three mutually perpendicular axes. One axes is to be perpendicular to the mounting plane. The vibration test shall be run at double amplitude or acceleration listed in Table 3 with a frequency sweep through the range of 10-2000-10 Hz at a rate of 1 octave/min (approximately 15.3/sweep). The test shall be run at room temperature. A nominal sending unit load for mid-scale pointer position shall be applied to the receiver unit. Sending units shall be run at approximately 50 percent of full scale measured parameter and for this purpose it shall be loaded with a suitable receiver unit. During the test run of either an receiver unit or a sending unit, the receiver unit pointer motion shall show no signs of electrical shorting or loss of electrical continuity. The permissible variation of the observed values from the initial values shall be ± 2 percent of full scale value. No abnormalities shall be observed in other parts. The receiver and sender unit shall be tested separately.

6.10 Endurance Test

The sender unit of the gauge is warmed from the lowest graduation temperature to 80 percent of the highest

graduation temperature and then cooled to the lowest graduation temperature. The process is repeated 5 000 times at the rate of 4 min/cycle. The permissible variation of the observed values from the initial values shall be ± 2 percent of full scale value. No abnormalities shall be observed in other parts.

6.11 Driving Rain Test

The test shall be done as per IS 9000 (Part 16), for 2 h. All the opening shall be suitably sealed except in case of waterproof gauge. The sensor shall be sprayed from eight side, four of them being directed at an angle of 45° on each of the uppermost corner and horizontal at the centre of the four side of the equipment. The gauge shall be sprayed horizontally at the centre of the four sides. After test, there shall be no visible entry of water inside the gauge and also the permissible variation between the observed values from the initial value shall be ± 2 percent of full scale value.

6.12 Salt Spray Test

When the receiver unit of the gauge is tested as per IS 9000 (Part 11) for 50 h consisting of two periods, each period being of 24 h of spraying and 1 h draining. After test, the gauge shall be subjected to the high voltage flash test (This is applicable for insulated type meter only.) and the permissible variation of the observed values from the initial values shall be ± 2 percent of full scale value. The visual appearance of the gauge after the test shall not prejudice assessment of results.

6.13 Dust Test

When the receiver unit of the gauge is tested as per IS 9000 (Part 12) for 5 h. All the opening shall be suitably sealed except in case of dust proof gauge. After test, there shall be no visible entry of dust inside the gauge and also the permissible variation of the observed values from the initial values shall be ± 2 percent of full scale value.

Table 3 Double Amplitude or Acceleration for the Vibration Test
(Clause 6.9)

Sl No.	Application	Frequency Range Hz	Double Amplitude mm	Acceleration g	Maximum Acceleration g
(1)	(2)	(3)	(4)	(5)	(6)
i)	Cab or instrument panel mounted receiver unit and chassis mounting sending unit	a) 10 – 32.5	2.00	—	4.2
		b) 32.5 – 2 000	—	4.2	4.2
ii)	Engine mounting sending unit	a) 10 – 70.5	2.00	—	20.0
		b) 70.5 – 120	—	20.0	20.0
		c) 120 – 2 000	—	10.0	10.0

6.14 Dry Heat Test

The test is to be carried out for receiver unit as per IS 9000 (Part 3/Sec 3) with a gradual change of temperature under the following conditions:

- a) Temperature : $70 \pm 3^\circ\text{C}$
- b) Duration of exposure : 4 h

After the test the gauge shall be cooled to the ambient temperature of 15 to 35°C and visually examined for any defects. The permissible variation of the observed values from the initial values after the test shall be ± 2 percent of full scale value.

6.15 Drop Test

The receiver unit of the gauge shall be tested as per IS 9000 (Part 7/Sec 3). The permissible variation of the observed values from the initial values after the test shall be ± 2 percent of full scale value.

6.16 Bump Test

After testing the gauge as per IS 9000 (Part 7/Sec 2) the permissible variation between the observed and the initial values shall not exceed ± 2 percent of full scale value.

6.17 High Voltage (Flash) Test

When the receiver unit of the gauge is subjected to a flash test at 500 V a.c. rms at a convenient frequency of 40 to 60 Hz between the gauge terminals and outer case. It shall satisfactorily withstand this test without arcing or puncture. This is applicable for insulated type meter only.

6.18 ADDITIONAL TESTING EXCLUSIVE TO ELECTRONIC TEMPERATURE GAUGE

6.18.1 Power Source Reverse Connecting Test

As to receiver unit for nominal voltage 12 V connect the test voltage of 13.0 V, for 24 V, the test voltage of 26 V with the reverse electrode for 1 min. After test, sample examine for the existence of abnormalities and the permissible variation of the observed values from the initial values shall be ± 2 percent of full scale value.

6.18.2 Over Voltage Test

The test to over voltage of receiver unit shall be in

accordance with the following:

- a) *Over voltage test (Long duration test)* — For receiver unit of nominal voltage 12V, apply the test voltage of 18V, for of 24V apply 36V and after actuating for 1 h, examine for existence of abnormalities of each part.
- b) *Over voltage test (Short duration test)* — For receiver unit of nominal voltage 12V, apply the test voltage of 24V, for 24V apply 48V, for 1 min and there after examine for existence of abnormalities of each part.

6.18.3 Transient Voltage Test

The receiver unit shall comply with requirements of ISO 7637-2 and ISO 7637-3.

6.18.4 Electromagnetic Compatibility Test

The receiver unit of the gauge shall meet statutory electromagnetic compatibility requirements.

7 HIGH TEMPERATURE WARNING INDICATION/ALARM

High temperature warning indication/alarm shall be provided with requisite colour code or suitable device as appropriate.

8 MARKING

8.1 The gauge shall be marked with symbol for the gauge, indication of the source of manufacture, serial number, date of manufacture, trade/brand name, printed preferably on the dial. Any other marking as agreed to between the supplier and the purchaser may also be printed on the dial.

8.2 BIS Certification Marking

The product may also be marked with the Standard Mark.

8.2.1 The use of the Standard Mark is governed by the provisions of *Bureau of Indian Standard Act, 1986* and the Rules and Regulations made thereunder. The details of conditions under which the licence for the use of Standard Mark may be granted to manufacturers or producers may be obtained from the Bureau of Indian Standards.

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Review of Indian Standards

Amendments are issued to standards as the need arises on the basis of comments. Standards are also reviewed periodically; a standard along with amendments is reaffirmed when such review indicates that no changes are needed; if the review indicates that changes are needed, it is taken up for revision. Users of Indian Standards should ascertain that they are in possession of the latest amendments or edition by referring to the latest issue of 'BIS Catalogue' and 'Standards : Monthly Additions'.

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Amendments Issued Since Publication

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